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Checklist of Determined Insect Specimens in the NCHU Museum of Entomology. I. Dytiscidae (Insecta: Coleoptera)

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Abstract. The NCHU Museum of Entomology, Department of Entomology, National Chung Hsing University is one of the important insect collections in Taiwan. This study aims to present a checklist of the determined diving beetles deposited at the NCHU Museum of Entomology, including 5 subfamilies, 9 genera, and 16 species.

Key words: Checklist, diving beetle, aquatic insect, NCHU museum of entomology

Introduction

The NCHU Museum of Entomology was inaugurated in 1947, and is located on the 10th floor of the Agricultural & Environmental Science Building of National Chung Hsing University. The NCHU Museum of Entomology is managed by the Department of Entomology, National Chung Hsing University, and is one of the most important entomological research collections in Taiwan, with holdings of more than 120,000 specimens (NCHU Museum of Entomology, 2019).

At present, 65 species from the family Dytiscidae are known to occur in Taiwan (Nilsson *et al*., 1995; Hendrich & Balke, 1997; Wang *et al*., 1998; Wewalka & Wang, 2007; Liu & Watanabe, 2018; Hájek *et al*., 2018; Watanabe *et al*., 2018). In this paper, a checklist of determined dytiscid specimens in the NCHU Museum of Entomology collection is provided. Consequently, 5 subfamilies, 9 genera, and 16 species are recognized.

Material and methods

All of the materials examined in this study are deposited at the NCHU Museum of Entomology, Department of Entomology, National Chung Hsing University, Taichung City, Taiwan. Species-level identifications were determined by the author. Where available, specimen label information relating to collection localities (in English and/or Chinese) is provided in square brackets. Abbreviation used in the paper: cf. (between the generic name and the species name) - this qualifier indicates that most of the diagnostic characters correspond to the species in question, but an examination of internal characters would still be required to support a species-level identification. Thus, while this identification is provisional, is likely to be definitive after a comparison of such characters with reference material.; ex - the sex of dytiscids cannot be easily determined without dissection, so this character is used for unidentified sex specimen(s).

Results

Family Dytiscidae 龍蟲科

Subfamily Agabinae 豆龍蟲亞科

***Platynectes gemellatus* Stastny, 2003 條紋扁形豆龍蟲**

Material examined. TAIWAN: 1 ex. Huisun Forest Area [= in Nantou County, 惠蓀林場], 18-22. I. 1999.

Subfamily Colymbetinae 姬龍蟲亞科

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***Rhantus suturalis* MacLeay, 1825 姬龍蝨**

Material examined. JAPAN: 1 ex. Kyusyu, Mt. Hiko-san, 16. VIII. 1941, M. Chujo leg.; 1 ex. Kyusyu, Mt. Hiko-san, 18. VIII. 1941, M. Chujo leg. **TAIWAN:** 1 ex. Taihoku [= in Taipei], 2. V. 1934, K. Sawada leg.; 1 ex. Taichung City, National Chung Hsing University [興大], 31. V. 1977, Shih-Cheng Horng leg.; 1 ex. Shilin District [= in Taipei City, 士林區], Zhishanyan [芝山岩], 9. VI. 1974, R. K. Lien leg.; 1 ex. Zhongxing New Village [= in Nantou County, 中興新村], 12. VII. 1975, Chiu-Kuei Chan leg.; 1 ex. Taichung City, National Chung Hsing University [興大], 23. X. 1980, Shang-Wen Huang leg.; 2 ex. Huisun Forest Area [= in Nantou County, 惠蓀林場], V. 1989, S. K. Su leg.; 1 ex. Taichung City, 1993, Debby leg.; 2 ex. Taoyuan City, Longtan District [龍潭], 2. I. 1994, L. H. Yang leg.; 2 ex. Label data unknown.

Subfamily Copelatinae 扁龍蝨亞科

***Copelatus* cf. *oblitus* Sharp, 1882 淡紋扁龍蝨**

Material examined. TAIWAN: 1 ex. Taichung City, National Chung Hsing University [興大], 1. I. 1994, JH Lee leg.; 1 ex. Taichung City, 30. V. 1994, Chih-Tsai Tsou leg.; 1 ex. Nantou County, Huisun Forest Rec Area, 1.5km from entrance, after rain, 500m, Acc Ti-82, 24.0802N 121.0053E, at u.v. light, 19. V. 2011, W. M. Hunting leg.

***Copelatus* cf. *sociennus* J. Bolfour-Browne, 1952 友朋扁龍蝨**

Material examined. TAIWAN: 1 ex. Pingdong co. [= Pingtung County], Longluan Lake [龍鑾潭], 21.58549N 120.44091E, by light, 29. VI. 2012, Shih-Ya Li leg.

***Lacconectus* cf. *formosanus* (Kamiya, 1938) 臺灣橙色扁龍蝨**

Material examined. TAIWAN: 5 ex. Nantou County, Lianhuachi [蓮華池], 4. V. 1991, F. Lee leg.; 2 ex. Taoyuan City, Fuxing township, Beichatien Mountain, 1320m, at night, by hand, 17. VI. 2011, W. M. Hunting leg.

Subfamily Dytiscinae 龍蝨亞科

***Rhantaticus congestus* Klug, 1833 擬姬龍蝨**

Material examined. TAIWAN: 1 ex. Nantou County, Lianhuachi [蓮華池], 1993, Fu-Hua Yan leg.; 5 ex. Miaoli County, 18. XII. 1993, Yu-Chien Chang leg.; 1 ex. Taichung City, Dakeng [大坑], VI. 1993, Fu-Hua Yang leg.; 3 ex. Miaoli County, Tongxiao Township [通霄], 4. XII. 1993, J. H. Lee leg.; 1 ex. Taichung City, 30. V. 1994, Tsai-Chih Tsou leg.

***Eretes griseus* (Fabricius, 1781) 灰色龍蝨**

Material examined. TAIWAN: 1 ex. Taichung City, Ziyou Road [自由路], IV. 1969.; 1 ex. Taichung City, Mt. Anma [鞍馬山], 1975, Mao-Tai Wang leg.; 1 ex. Taichung City, Taiwan Provincial Consultative Council [省議會], 23. III, 1975, Hsuen-Chin Li leg.; 1 ex. Taichung City, National Chung Hsing University [興大], 20. V. 1975, Jui-Shan Chen leg.; 1 ex. Liouguei [in Kaohsiung City, 六龜] 6. VII. 1978, I-Ming Li leg.; 1 ex. 10. X. 1978, Chiao-Chen Hung leg.; 1 ex. 15. X. 1978, Chiao-Chen Hung leg.; 6 ex. Tainan City, Shanhua [善化], 18. VII. 1979, Hsin-Ping Wang leg.; 1 ex. Taichung City, National Chung Hsing University [中興], 31. V. 1985, M. L. Cheung leg.; 7 ex. Taichung City, Wufeng [霧峰], 1993, T. Z. Chen leg.; 1 ex. Taichung City, National Chung Hsing University [興大], 20. V. 1994, W. Y. C. leg.; 1 ex. Taichung City, Fengyuan Dajia River, by hand, 10. X. 2018, Yi-Hao Lin leg.; 19 ex. Label data unknown.

***Hydaticus grammicus* (Germar, 1827) 棕紋麗龍蝨**

Material examined. JAPAN: 1 ex. Kyusyu, Mt. Hiko-san, 18. VIII. 1941, M. Chujo leg.

***Hydaticus rhantoides* Sharp, 1882 姬麗龍蝨**

Material examined. TAIWAN: 1 ex. Taihoku [= in Taipei], 13. IV. 1934, K. Sawada leg.; 1 ex. Taichung City, 26. V. 1975, Hsuen-Chin Li leg.; 1 ex. Taichung City, National Chung Hsing University [興大], 1976, Hsien-Lung Lin leg.; 1 ex. Taichung City, 14. III. 1976, Li-Shan Lin leg.; 1 ex. Sitou [=in Nantou County, 溪頭], 1977, J. T .W leg.; 1 ex. Taichung City, National Chung Hsing University [中興大學], 26. VI. 1977, Ching-Chou Tseng leg.; 1 ex. Taichung City, National Chung Hsing University [興大], 6. VII. 1977, Yung-Chien Cheng leg.; 1 ex. Taichung City, Guguan [谷關], 4. XI. 1977, Pai-Peng Hsiao leg.; 1 ex. Taichung City, National Chung Hsing University [興大], V. 1978, Jan.-Tseng. Hsu leg.; 1 ex. Huisun Forest Area [= in Nantou County, 惠蓀林場], V. 1989, S. K. Su leg.; 1 ex. Pingtung County, Nanren Lake Wetland [南仁湖], 11. V. 1989, Y. H. Huang leg.; 2 ex. Taichung City, National Chung Hsing University [中興大學], 1993, Y.-H. Fu leg.; 1 ex. Taichung City, National Chung Hsing University [興大], 15. XI. 1993, Y.-W. Tsai leg.; 1 ex. Taichung City, Dakeng [大坑], 24. XI. 1993, Y.-W. Tsai leg.; 1 ex. Taichung City, 25. XII. 1993, D. W. L leg.; 2 ex. Taichung City, National Chung Hsing University [興大], 6. I. 1994, C. P. Lin leg.; 1 ex. Taichung City, National Chung Hsing University [中興大學], 20. V. 1994, W. Y. C leg.; 1 ex. Taichung City, National Chung Hsing University [中興大學], 1. VI. 1994.; 2 ex. Taichung City, National Chung Hsing University [興大], 4. VI. 1994, Yu-Chien Chang leg.; 1 ex. New Taipei City, Wulai District, Tonghou hiking trail, 24.8196N 121.6871E, m. v. light sheet on trail, 740m, Acc Ti-147a, 4. XI. 2011, W. Hunting, C. T. Tang leg.; 1 ex. Pingdong co. [= Pingtung County], Longluan Lake [龍鑾潭], 21.58549N 120.44091E, by light, 29. VI. 2012, Shih-Ya Li leg, No. 0009-0524.; 10 ex. Label data unknown.

***Hydaticus vittatus* (Fabricius, 1775) 黃紋麗龍蝨**

Material examined. TAIWAN: 1 ex. Miaoli County, Tongxiao Township [通霄], 4. XII. 1993, J. H. Lee leg.; 1 ex. Label data unknown.

***Cybister chinensis* Motschulsky, 1854 日本大龍蝨**

Material examined. 1 ex. Label data unknown.

***Cybister rugosus* (MacLeay, 1825) 橙斑大龍蝨**

Material examined. TAIWAN: 1 ex. Pingtung County, Nanjenshan, 12. II. 1985, Z. Y. Huang leg.

***Cybister sugillatus* Erichson, 1834 紅邊大龍蝨**

Material examined. TAIWAN: 2 ex. Taitung County, Lanyu [蘭嶼], VIII. 1969, S. C. Chang.; 1 ex. Taipei City, Zhinan Temple [指南宮], 10. X. 1993, Y. T. Horng leg.; 1 ex. Miaoli County, Tongxiao Township [通霄], 4. XII. 1993, J. H. Lee leg.

***Cybister tripunctatus* (Olivier, 1795) 點刻三線大龍蝨**

Material examined. TAIWAN: 1 ex. Taitung County, Donghe [東河], 8. IV. 1971, Jih-Ching Lien leg.; 1 ex. Yangmingshan [= in Taipei City, 陽明山], Zhishanyan [芝山岩], 23. XI. 1972, Jih-Ching Lien leg.; 1 ex. Dongshi [= in Taichung City, 東勢], 20. V. 1973, Ming-Che Chou leg, No. 0011-0318.; 1 ex. Taichung City, Taiwan Provincial Consultative Council [省議會], 7. V, 1975, Po-Hsien Chen leg, No. 0011-0317.; 1 ex. Huisun Forest Area [= in Nantou County, 惠蓀林場], 12. V. 1977, Hsin-Yuan Su leg, No. 0011-0313.; 1 ex. Taichung City, 10. VII. 1977, C. T. Yang leg, No. 0011-0315.; 1 ex. Taichung City, Taiwan Provincial Consultative Council [省議會], 3. V. 1978, Chao-Feng Chen leg, No. 0011-0317.; 1 ex. Taichung City, National Chung Hsing University [興大], 21. V. 1978, Chun-Kuei Chen leg, No. 0011-0314.; 1 ex. Taichung City, National Chung Hsing University [興大], 1980, Kai Chin leg, No. 0011-0316.; 1 ex. Chiayi County, Budai [布袋], 12. II. 1990, C. H. Tung leg, No. 0011-0319.; 1 ex. Nantou County, Lianhuachi [蓮華池], 4-5. V. 1991, C. H. Tung leg, No. 0011-0322.; 2 ex. Miaoli County, 4. XII. 1993, P. J. H leg.; 1 ex. Miaoli County, 24. XII. 1993, Elaine Shyu leg, No. 0011-0323.; 15 ex. Label data unknown.

Subfamily Laccophilinae 粒龍蝨亞科

***Laccophilus chinensis* Boheman, 1858 中華粒龍蝨**

Material examined. TAIWAN: 5 ex. Taichung City, 31. X. 1988, C. F. Hung leg.; 2 ex. Taichung City, 9. XI 1993, Y. H. Leu leg.; 3 ex. Taichung City, 20. XI. 1993, L. J. K leg.; 1 ex. Miaoli County, 4. XII. 1993, P. J. H leg.; 3 ex. Taichung City, 29. XII 1993, J. R. S leg.; 2 ex. Taichung City, National Chung Hsing University [興大], 29. XII. 1993, Y. C Li leg.; 2 ex. Pingtung Co., Kenting National Park, Hengchun Research Station, aquatic plant garden, at light, 19. VIII. 2008, Tsai, JF & Rédei, D leg.

***Laccophilus sharpi* Regimbart, 1889 夏普氏粒龍蝨**

Material examined. TAIWAN: 1 ex. Miaoli County, Tongxiao Township [通霄], 8. VI. 1993, J. T. P leg.; 2 ex. Taichung City, 20. XI. 1993, L. J. K leg.; 1 ex. Pingtung Co., Kenting National Park, Hengchun Research Station, aquatic plant garden, at light, 19. VIII. 2008, Tsai, JF & Rédei, D leg.; 3 ex. Label data unknown.

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國立中興大學昆蟲標本館昆蟲定名標本名錄：I. 龍蝨科（昆蟲綱：鞘翅目）

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摘要: 國立中興大學昆蟲標本館為臺灣重要的昆蟲標本蒐藏館。此研究提供國立中興大學昆蟲標本館的龍蝨科定名標本名錄，共紀錄 5 亞科，9 屬，16 種。

關鍵詞: 名錄、龍蝨科、水生昆蟲、國立中興大學昆蟲標本館

[研究文章 Research Article]

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Coptotermes gestroi: an Invasive Pest Discovered in Eastern Taiwan for the First Time (Blattodea: Rhinotermitidae)

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Abstract: This paper reports the first observation of the invasive Asian subterranean termite, *Coptotermes gestroi* (Wassmann, 1896), in eastern Taiwan. The known distribution of *C. gestroi* in Eastern Taiwan is mapped, and potential routes by which *C. gestroi* may further disperse throughout this region are also discussed.

Keywords: Termite, invasive species, distribution, urban pest

Introduction

Two species of termites from the rhinotermitid genus *Coptotermes* Wasmann are known to occur in Taiwan: the native *Coptotermes formosanus* Shiraki, 1909, and the invasive *Coptotermes gestroi* (Wassmann, 1896). *C. formosanus* and *C. gestro*i were found to be the most destructive termite pests in Taiwanese urban areas, with more than 87% of termite infestations caused by these species (Li et al., 2011). The invasive Asian subterranean termite, *C. gestroi*, was first reported in Taiwan in 2003, having been identified based on the morphology of soldiers and workers (Tsai & Chen, 2003). During the flight season in Taiwan, winged *C. gestori* imagos were observed from March to May (Yang & Li, 2012). Li et al. (2013,) indicated that *C. gestroi* is a tropical species, which has been found most commonly in warm, low altitude areas with high rainfall, and generally in close proximity to human habitation; correspondingly, a more recent survey by Chiu et al. (2019) suggests that *C. gestroi* populations would be unlikely to spread into the more mountainous mid-to-high altitude areas of Taiwan.

The putative native range of *C. gestroi* is thought to include Indonesia, Malaysia, and the Philippines (Chouvene et al., 2015). Based on mitochondrial sequences analysis, invasive *C. gestroi* populations in Taiwan are speculated to have been introduced from the Philippines (Li et al., 2009; Yeap et al., 2013). Up to the present, established *C. gestroi* populations were known to be restricted to south-western Taiwan, mostly within an area of urbanized and agricultural zones between Taichung and Pingtung (Tsai & Chen, 2003; Li et al., 2009; Su et al., 2017; Chiu et al., 2019). Despite sporadic records of *C. gestroi* workers and soldiers from outside this area, namely, in parts of the northern and central regions of Taiwan, *C. gestroi* alates have yet to be observed in these regions, and thus, these records are thought to represent non-reproductive fragments of colonies from the south-west, which have be moved to these other localities by humans, likely via the transport of timber products (Tsai & Chen, 2003). Su et al. (2017) suggested that the northern expansion of the *C. gestroi* in Taiwan could be a recent event, based on an examination of recent collection records.

In the present study, the authors report the first observation of *C. gestori* in eastern Taiwan, based on the collection of numerous *C. gestroi* alates during a recent fieldtrip to Beinan Township, Taitung County. Potential routes by which *C. gestroi* may further disperse throughout eastern Taiwan are also discussed.

Materials and methods

Winged imagoes of *Coptotermes gestroi* were collected from Zhiben station, Beinan Township, Taitung County (22.710262, 121.060768); these samples were preserved in 95% ethanol. Diagnosis was based on the key of Yang & Li (2012). All voucher specimens were deposited in the Urban Entomology Laboratory, Department of Entomology, National Chung Hsing University (Taichung County, Taiwan).

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All specimen images were generated using the Z-stacking technique. Z-stacks images were acquired with a Leica MC170 HD digital camera attached to a Leica M205 C stereomicroscope, using LAS software (version 4.4.0, Leica Application Suite, Wetzlar, Germany); stepping was achieved by hand. Z-stacks were aligned and merged using CombineZP software (Hadley, 2010), using the settings 'Align and Balance Used Frames' for alignment, and 'Do Stack' for merging. Merged images were subsequently processed in Adobe Photoshop and Adobe Illustrator CS5. The *C. gestroi* Taiwanese distribution map (Fig. 3) was modified from that of (Su et al., 2017), using Adobe Illustrator CC (64 Bit). This distribution map's legend is as follows: within the Taiwanese land area (coastline indicated by black border), grey areas indicate elevations above sea level of 100m or greater, while white areas indicate elevations from approximately sea level to 100m above sea level; red areas indicate the assumed distribution of the *C. gestroi* in Taiwan, based on (Su et al., 2017); the red circle indicates the location of isolated observations of *C. gestroi* in northern Taiwan; the red star indicates the location of the first *C. gestroi* record in eastern Taiwan, as reported in this paper.

Results

***Coptotermes gestroi* (Wasmann, 1896)**

(Figs. 1-2)

Materials examined. 50 alates, TAIWAN: Taitung Co., Zhiben Station (22.710262, 121.060768), Beinan Township, 06.IV.2019, F, -S, Hu leg., TW7936.

Diagnosis (Modified from Yang & Li, 2012). Alates of *C. gestroi* may be distinguished from those of *C. formosanus* by following characters: head, thorax, and abdomen are pale brown, inside of ocellus with a pair of crescent-like stripes.

Remarks. The winged *C. gestroi* imagoes were attracted by the artificial light source in the Zhiben railway station on April 6th 2019. These imagos were observed starting to fly at about 18:30, when the temperature was about 25 ℃. No rainfall was recorded for that day at this location.

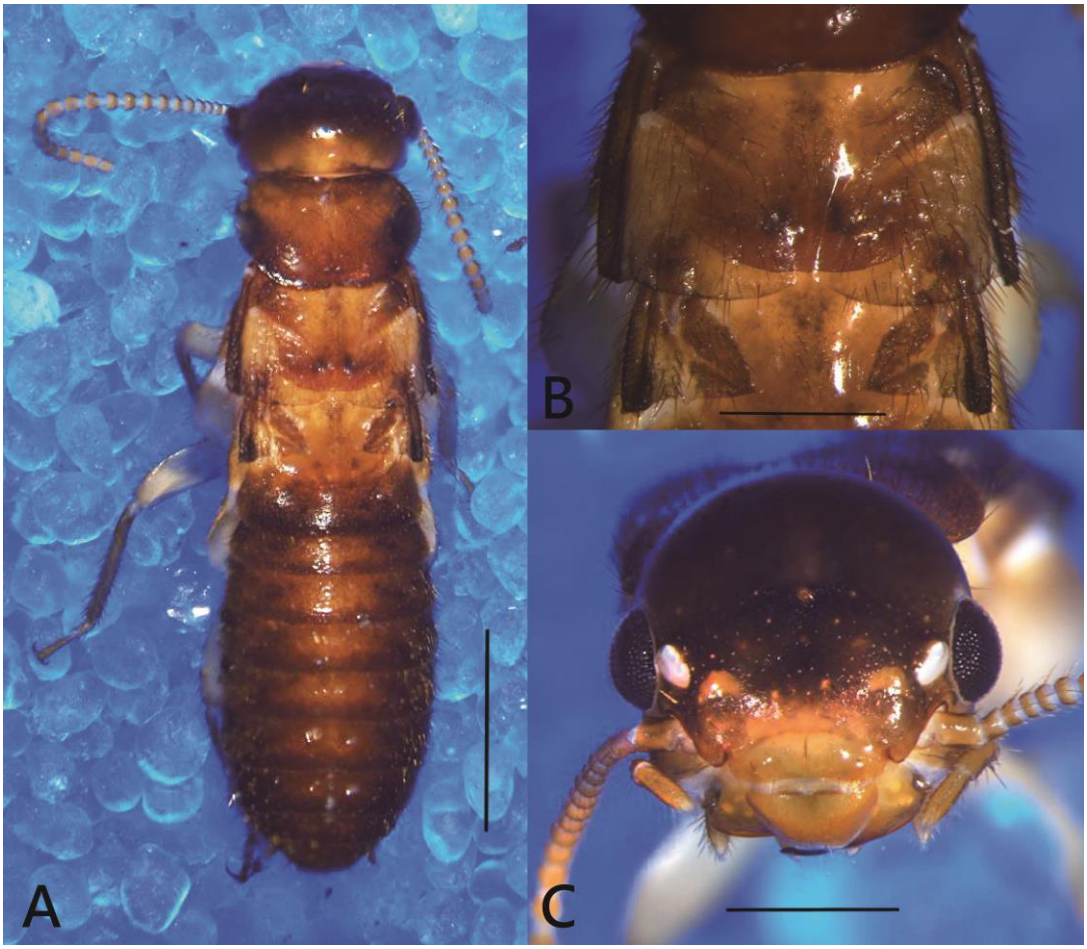

Figure 1. Habitus, wing base, and head of alates of *Coptotermes gestroi* from eastern Taiwan. A - Body habitus, scale bar: 1 mm; B - wing base, scale bar: 0.5 mm; C - head in frontal view, scale bar: 0.5 mm.

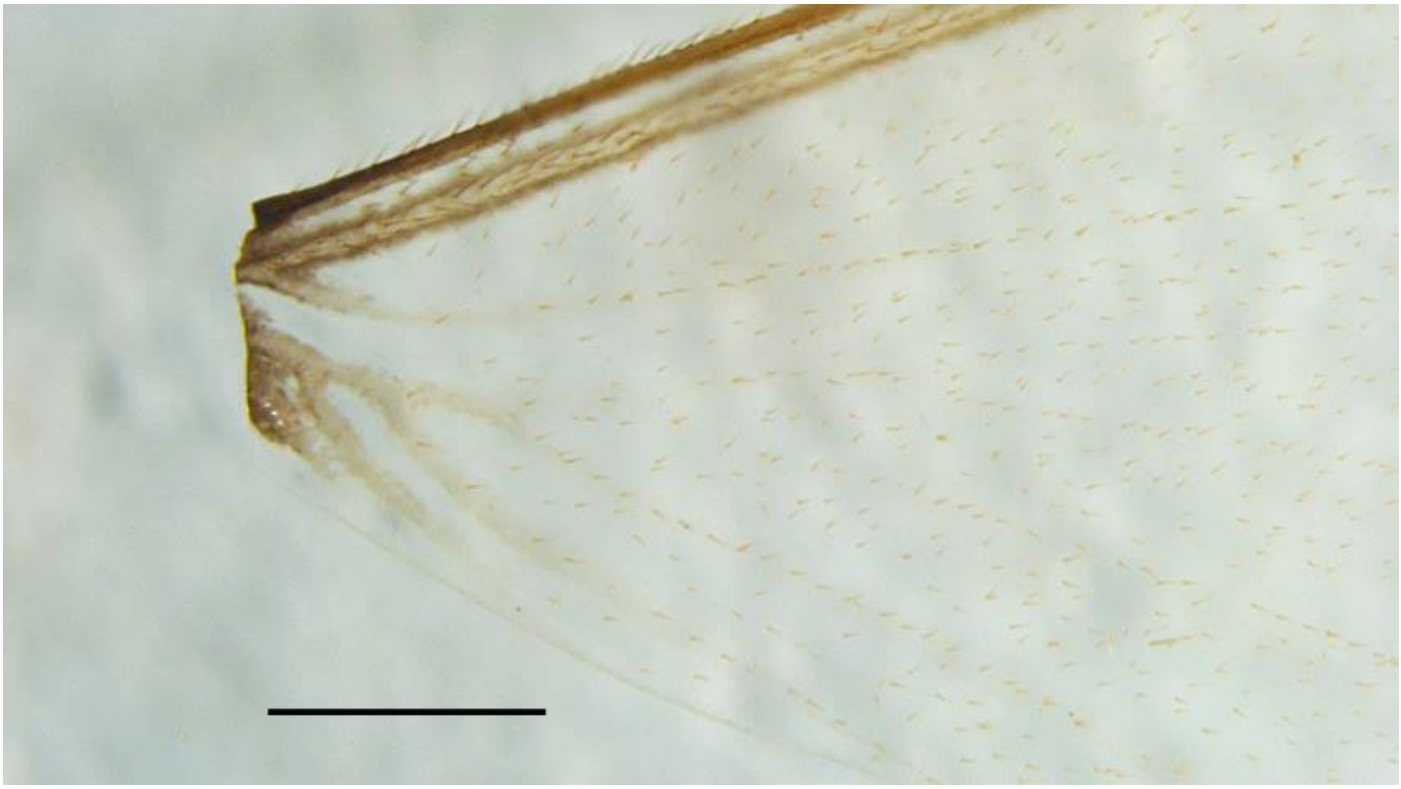

Figure 2. Wing surface of *Coptotermes gestroi* from eastern Taiwan, scale bar: 0.5 mm.

Discussions

Until 2016, almost all Taiwanese collection specimens of *Coptotermes gestroi* had been collected from south-western Taiwan (Su et al., 2017). The voucher specimens mentioned in this paper are the first recorded specimens of *C. gestroi* to be observed in eastern Taiwan. Most winged imagoes of *Coptotermes* spp. have previously been observed in the field being less than 250 m from their original colony (Mullins et al., 2015), and therefore, the observation of winged imagoes in a given locality is likely to indicate the presence of an established colony in this locality (Chouvenc & Su, 2014). However, based on the apparent preferences *C. gestroi* has shown for warm, lowland areas with high rainfall that are in close proximity to human habitation, it would therefore be expected that certain parts of eastern Taiwan (at about the same latitude as *C. gestroi*'s known range in Western Taiwan), particularly the lowland of Taitung, and even the southern part of Hualien, would provide a suitable habitat for this species. Nevertheless, *C. gestroi* had not previously been observed here, which begs the question: why hasn't this species been collected in eastern Taiwan until now?

Li et al., (2013) indicated that *C. gestroi* is most commonly be found in lowland area close to human populations, as most Taiwanese records of *C. gestroi* come from localities with these characteristics. Thus, much of the south-western region of Taiwan provides a suitable habitat for *C. gestroi*. On the other hand, most parts of the southern Taitung region are mountainous and less developed. As a result, the most likely routes by which *C. gestroi* may further disperse throughout eastern Taiwan are along the southern and eastern coastlines, and through the lower altitude areas of Pingtung County in southern Taiwan.

Su et al. (2017) proposed that the northern expansion of *C. gestroi* is likely to be a relatively recent event. Our observation suggests that the spread of *C. gestroi* throughout south-western Taiwan probably occurred earlier than the establishment of this species in south-eastern Taiwan, and that *C. gestroi* populations in south-eastern Taiwan were probably introduced from south-western Taiwan. Therefore, closer monitoring of *C. gestroi* populations in eastern Taiwan is needed. The current known distribution of *C. gestroi* is shown in Figure 3. below.

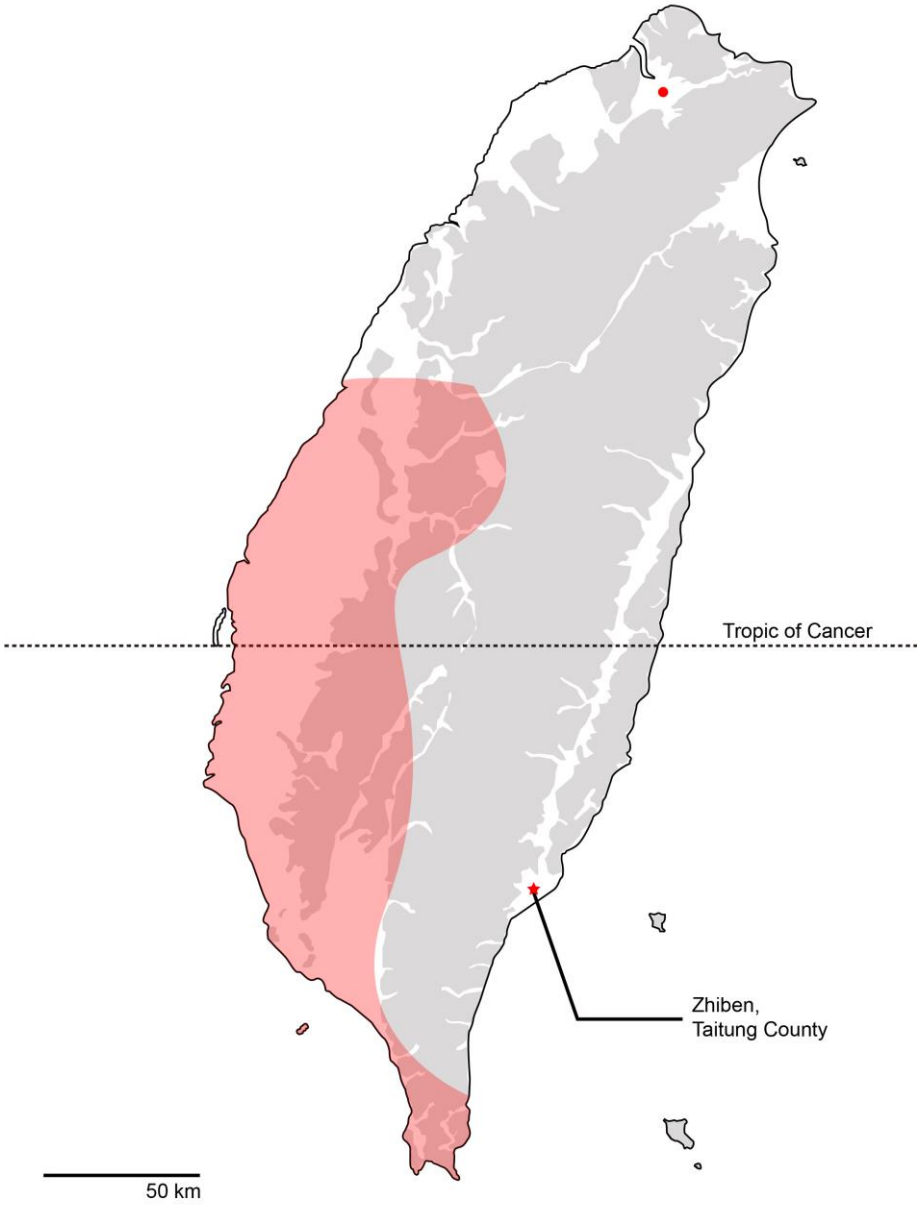

Figure 3. Distribution of *C. gestroi* in Taiwan (modified from Su et al., 2017).

Acknowledgements

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入侵性害蟲：格斯特家白蟻首次發現於東臺灣（蜚蠊目：鼻白蟻科）

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摘要: 首次報導格斯特家白蟻發現於東臺灣，並提供格斯特家白蟻在臺灣之最新分佈圖。本文亦探討其在東臺灣可能之擴散路徑。

關鍵字: 白蟻、入侵物種、分佈、都市害蟲

[研究文章 Research Article]

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日本姬螳錯誤上背行為之短記（螳螂目：花螳科）

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摘要: 螳螂目中偶有雄螳錯誤上背於異種雌螳的情形，可能肇因於費洛蒙或視覺線索的錯誤辨識，但鮮少雄螳錯誤上背於異種雄螳的情況。本文初次描述雄日本姬螳的錯誤上背於雄綠靜螳，同時也為臺灣產螳螂的第一筆野外錯誤上背之正式紀錄，並討論此現象發生之可能原因。

關鍵詞: 異種交配行為、配偶錯誤辨識、上背、性費洛蒙、臺中市

前言

一般而言，螳螂目 (Mantodea) 種類的求偶行為大致可分為兩階段：遠距離時的性費洛蒙誘引和近距離下的視覺辨識 (Maxwell, 1999)，目前僅有少數種類的性費洛蒙成分已被分析 (Hurd et al., 2004)，但雄蟲在視覺上判斷同種雌蟲的基準為何現今依然成謎。在實驗室或人工飼養環境下，錯誤上背的情況偶有發生，但野外被發現的案例幾稀，更遑論較正式的文獻記載。

本文第二作者於 2018 年 5 月 15 日 16 時，在臺中市大坑中正露營區廁所附近發現一隻日本姬螳 *Acromantis japonica* Westwood, 1889 雄成蟲錯誤上背於綠靜螳 *Statilia nemoralis* Saussure, 1870 雄成蟲。本文為首篇野外日本姬螳錯誤上背的正式紀錄、同時也為臺灣產螳螂的第一筆野外錯誤上背之正式紀錄。

材料與方法

本研究以 Canon 550D 數位單眼相機，搭配 Canon EF-S 18-55mm f/3.5-5.6 鏡頭、相機內建閃燈拍攝。

結果

日本姬螳與綠靜螳

***Acromantis japonica* Westwood, 1889 & *Statilia nemoralis* Saussure, 1870**

(圖一)

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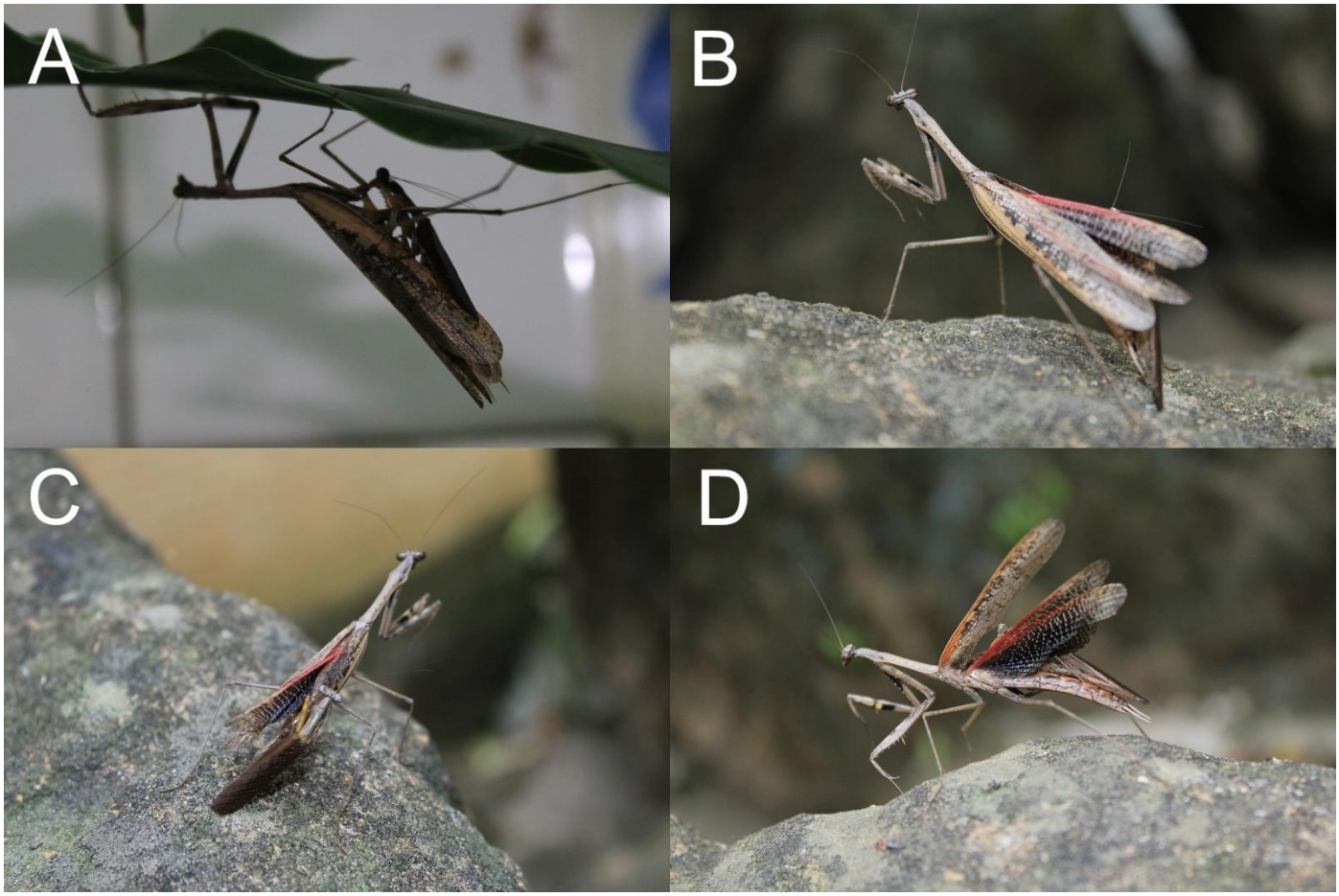

圖一、A. 在 16:06 初發現時倒吊於廁所中植栽葉背的綠靜螳與日本姬螳 (拍攝時間：16:07)；B. 日本姬螳攀附於綠靜螳右側後方，呈交配準備姿勢並彎曲腹部 (拍攝時間：16:09)；C. 在綠靜螳多次振翅及移動中，日本姬螳也多次調整位置，曾攀附於綠靜螳之右翅 (拍攝時間：16:09)；D. 綠靜螳揚起前後翅，日本姬螳則攀附於腹部之上 (拍攝時間：16:10)。

觀察記述：本次總觀察時長約 5 分鐘。綠靜螳雄成蟲被發現倒吊於中正露營區廁所周圍的植栽葉背，發現時其腹部腹側有一日本姬螳雄成蟲攀附於上，從發現起約 1 至 2 分鐘內掉落，其倒吊期間幾無移動。綠靜螳自葉背掉落後，間歇性的快速步行與短距離跳躍振翅，直至觀察者離開之際仍有斷斷續續的運動。日本姬螳在被發現時，其前足勾住綠靜螳之中足、中後足攀附於綠靜螳之前翅。兩者自葉背掉落後，日本姬螳起初以前足抓住綠靜螳的翅膀，並於綠靜螳移動期間改變攀附位置，轉而停於綠靜螳的腹部背側，其過程中日本姬螳多攀附於綠靜螳的身體右側。

討論

目前螳螂目中錯誤上背 (mismounting)、異種配對 (heterospecific mating) 最有名的案例為紐西蘭直胸螳 (*Orthodera novaezealandiae* Colenso, 1882) 與斑光螳螂 (*Miomantis caffra* Saussure, 1871)，紐西蘭本地的雄性紐西蘭直胸螳會受到外來種的雌斑光螳螂之性費洛蒙吸引而上背 (Fea et al., 2013)，其高頻率的錯誤上背甚至曾導致紐西蘭直胸螳的族群幾乎覆滅；此外，雄性薄翅螳螂 (*Mantis religiosa* Linnaeus, 1758) 也曾有受到雌中華大刀螳 (*Tenodera sinensis* Saussure, 1871) 的性費洛蒙吸引的紀錄 (Lelito & Brown, 2008)。以上案例皆為雄螳螂受到不同種類雌性之性費洛蒙吸引而至，且於視覺上的配偶錯誤辨識而導致，但本文的被上背者為雄性綠靜螳，而目前並無報告指出雄螳螂會釋放性費洛蒙，故本次現象之成因可能與過往研究不盡相同。

一般而言，雄螳螂以觸角接收到性費洛蒙之後，會先循著氣味搜索雌螳，在此階段的運動模式通常為飛行或快速移動；而當近距離以視覺偵測到雌螳後，其接近過程中的運動模式也會轉變為極度緩慢、甚至趨於靜止的步行，並於接近至合適距離後上背 (Maxwell, 1999; Allen et al., 2012)。因此我們推測：可能附近有雌性日本姬螳正在釋放性費洛蒙，循著氣味而來的雄日本姬螳在鄰近區域發現了雄綠靜螳，並將其錯誤辨識為同種雌蟲後導致錯誤上背行為出現。目前尚未有相關研究解構雄螳螂在近距離視覺上用以辨識雌螳的物理因子，希望未來能有進一步的研究能揭開謎團。

O' Hanlon et al. (2018) 研究中所使用的三種螳螂，在遭受攻擊後都有威嚇展示 (deimatic display) 的行為出現，但我們在觀察期間既未發現綠靜螳使用前足攫取或攻擊日本姬螳、也沒有威嚇展示，只有間歇性的快速移動。然而，不少種類的雌螳螂有能力旋轉前胸、用前足攻擊背上的雄螳螂，在 Michael (1999) 整理的 27 種有發生性食的種類中，便有 17 種的雌蟲曾有攻擊其背上雄蟲的記錄，而在筆者的個人經驗中，雄性綠靜螳也有能力將前足伸展至日本姬螳的所在位置。因此在觀察過程中，雄綠靜螳完全沒有使用前足干擾日本姬螳的攀附也是本案例的有趣之處，其相關機制也依然不明朗，期待還有後續的研究。

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Notes on Mismounting Behavior of *Acromantis japonica* (Mantodea: Hymenopodidae)

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Abstract. While heterosexual mismounting between heterospecific Mantodea is occasionally observed in the wild, it does not appear to be a common occurrence, and likely results from misidentifications of pheromone and/or visual cues by mantises. However, accounts of homosexual mismounting between heterospecific male mantises are extremely rare in the literature. The present study provides the first account (to our knowledge) of homosexual mismounting by a male *Acromantis japonica* Westwood, 1889 on a male *Statilia nemoralis* Saussure, 1870. This is also as the first formal record of mismounting between Taiwanese mantises in the wild. The possible causes of this rarely observed phenomenon are also discussed.

Key words: Heterospecific mating behavior, mate misidentification, mounting, sex pheromone, Taichung City

[圖影短訊 F&V Communication]

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臺灣產台東櫛大蚊產卵短記（雙翅目：大蚊科）

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2019 年 6 月 25 日作者於桃園市桃園區虎頭山海拔約 200 公尺處發現一隻台東櫛大蚊 (*Ctenophora scalator*) 在山徑邊的腐木堆重複數次產卵的行為。可由腹部末端尖細有產卵器的構造辨識該大蚊為雌蟲。腐木堆之潮濕積土處為雌蚊產卵場所，腐木已腐朽至無法辨識可能樹種，腐木長有數種真菌，同月份作者亦於此腐木堆發現大偽瓢蟲 (*Eumorphus quadriguttatus pulchripes*) 的若蟲、成蟲、扁鍬形蟲 (*Dorcus titanus sika*) 及橙頭土蜂屬 (*Scolia* sp.) 的物種。雌蚊產卵時，雙翅展開和地面平行，頭和胸部向前傾，幾乎與腹部呈 90 度彎曲，六隻腳支撐地面，腹部幾近筆直的插入地下產卵。本研究提供雌蚊產卵場所之資訊以協助往後研究對於台東櫛大蚊之生活史資訊的探索。

圖、A - 台東櫛大蚊 (*Ctenophora scalator*) 產卵之腐木堆；B - 台東櫛大蚊雌蚊產卵。

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臺灣研蟲誌 Taiwanese Journal of Entomological Studies 4(3): 32-33 (2019)

Notes on Laying Behavior of *Ctenophora scalator* (Alexander, 1920) in Taiwan (Diptera: Tipulidae)

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臺 灣 研 蟲 誌

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本會為臺灣昆蟲(含蛛形)愛好者所組成，廣納研究同好為會友，以定期與不定期方式舉辦各種研討聚會、發行昆蟲(含蛛形)自然史相關觀察研究期刊，凝聚全臺愛好者，以促進我國昆蟲、蛛形自然史之發展。

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